

inhibitors of the enzymes involved might offer a new approach to insect control. Proteolytic enzymes are involved in many aspects of insect development and metabolism, so that specific inhibitors for, e.g. midgut proteinases, may have devastating effects on larval development.

The last two papers, on cholinergic receptors, will stimulate students of ion-channel structure. In particular, that on the interaction of philanthotoxins (from the wasp, *Philanthus triangulum*) with the nicotine acetylcholine receptor, discusses this receptor in detail and offers thought-provoking ideas about the way these fascinating toxins bind in the associated cation channel.

The information is well presented and referenced, with author, affiliation and subject indexes. The book well demonstrates the ingenuity employed in the search for modern pest control agents. There is a wealth of detail to up-date those engaged in basic research, with suggestions for as yet unexplored molecular targets which will provide ideas for others seeking new and environmentally compatible agents for integrated pest/crop management systems.

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Crop protection agents from nature: natural products and analogues, ed. Leonard G. Copping, The Royal Society of Chemistry, Cambridge, for the SCI, 1996, xvii + 501 pp., price UK £129.50.
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This book is Volume 35 of the Society of Chemical Industry's series of Critical Reports on Applied Chemistry. There can be few more fascinating intellectual stimulants than the activities that surround the isolation and identification of useful bioactive chemicals from natural sources. Rapid screening methods combined with modern separative and physicochemical techniques have accelerated the process enormously in recent years, but there still remains the final challenge for the synthesis chemist to develop often extremely elegant total syntheses for structural confirmation and for production purposes.

About half the book (Ch. 1–5) deals with bioactive chemicals from microbial sources, the centre portion with bioactives from higher plants (Ch. 6–8), Ch. 9 with venoms and toxins mainly as leads for insecticides, and the remainder (Ch. 10–14) with biopesticides and regulatory matters. Chapter 1 demonstrates the complexity of the subject. It is a thoughtful introduction which tabulates bioactive secondary metabolites in terms of the taxonomic position of the producing organism, the chemical classes of the metabolites produced and their mode of action, with specific mention of an insecticide (avermectin), a fungicide (validamycin), a herbicide (phthoxazolin) and a nematocide (*trans*-2-decenedioic

acid), as examples of the discovery process. Further examples of antifungal, antibacterial, insecticidal and herbicidal compounds are given in Ch. 2, which also discusses molecular biological applications of the genes conferring resistance to the rice fungicide blastidicin S and the herbicide bilanofos.

Chapter 3 is a fascinating, detailed account of the parallel researches at BASF and ICI, which led from the antifungal natural product strobilurin A, isolated from *Strobilurus tenacellus*, to new, broad-spectrum synthetic fungicides. Chapter 4, entitled 'Phytotoxins of Microbial Origin with Potential for use as herbicides', tabulates known modes of action and chemical classes and concludes that the potential for future discovery in this area is enormous. The extraordinary potential of algae as sources of bioactive compounds is expounded at length in Ch. 5, which has 177 chemical structures, 612 references and extensive tabular material in support. For reasons discussed in the Conclusions, algae are a largely untapped source of pharmaceuticals and/or agrochemicals.

Chapter 6 has the overall title of 'Pesticides from Nature' and is subdivided into Part I—an overview of crop protection agents from higher plants, Part II—studies from China on Plants as Sources and Models of Insect control Agents and a short part III, which serves both as a summary of what has gone before and an introduction to Michael Elliot's tour-de-force (Ch. 7) entitled 'Synthetic Insecticides related to the Natural Pyrethrins', which, fittingly, occupies the centre of the book. This is the now classical example of what can be achieved by the patient exploration of a natural product lead and the narrative style of this presentation makes it compelling reading.

Next come 'Natural Defence Mechanisms of Plants' and 'Animal Venoms and Insect Toxins as Lead Compounds for Insecticides' (Ch. 8 and 9, respectively). Chapter 8 begins with secondary metabolites having potential broad-spectrum protective effects against both pathogens and predators, moves on to chemicals acting more specifically against each of these groups, and thence into induced responses, including phytoalexins (which are tabulated) and concludes with a discussion of the mechanisms in plant responses to infection and predation.

Perhaps on account of primeval fears, a certain fascination attends the subject of toxins, which are reviewed species by species, with their poisoning symptoms, in Ch. 9. There are undoubtedly leads here for new syntheses, although the major use of many of these chemicals is in neuroscience research. The problems for toxins as control agents lies in getting them to the molecular sites of action within target organisms. Ingenuity can overcome these problems, as illustrated in Ch. 10, 'Diversity and Biological Activity of *Bacillus thuringiensis*' and Ch. 11 'Natural and Engineered Viral Agents for Insect Control'. Together, these chapters

demonstrate how these living agents can be used directly, either as they occur naturally, or following genetic modification. Alternatively, the techniques of molecular biology can be used to generate microbial toxins *in situ* in a species to be protected and viruses can be engineered to express genes that encode toxins or enzymes detrimental to the species infected.

The direct use of micro-organisms is expanded in Ch. 12, 'Micro-organisms for Plant Disease Control' and Ch. 13, 'Microbial Herbicides—Factors in Development'. These agents have an optimistic future as part of programmes of integrated pest/crop management but progress toward practical use has been slow so far and the difficulties attending commercialisation for small, specialised markets, where there is still strong competition from synthetic chemicals, are considered in these chapters.

Not all naturally produced chemicals are safe, as is evident from Ch. 5 and Ch. 9, and many would be treated as conventional pesticides for regulatory purposes. Others are regarded as 'biochemical pest control agents' (e.g. pheromones, natural insect and plant growth regulators and enzymes), as distinct from the microbial pest control agents surveyed in Chs 10–13. The prospects for the latter, as natural, specific, short-lived and therefore environmentally more acceptable control agents are overshadowed by public concerns, real or not, about unforeseen effects of their release into the environment, particularly if genetic manipulation is involved. Clearly, it will take time and experience to alleviate these concerns. The final chapter (14) on 'The Registration of New Natural Products', summarises the regulatory requirements specified by the US EPA for naturally produced chemicals, their synthetic analogues and the biopesticides discussed in the latter part of the book. This review demonstrates the complexity of the subject and the burdensome nature of the regulatory requirements, but, on the other hand, shows the care that is taken in regard to the use of these materials in practice.

The range of organisms considered and the diversity of the chemicals they produce, some with more than one type of biological activity, make the organisation of such a text no easy task. Rapid access by the reader is aided, however, by division of the chapters, all written by international experts in their fields, into sub-sections which are fully listed in the Contents section.

The long-standing interest in this area is stimulated by the advent of rapid screening techniques as the search for leads to environmentally acceptable agrochemicals intensifies. With more than 2100 references and illustrations of some 500 chemical structures, the book merits a place in libraries and should be a valuable information source for research workers as well as others with a general interest in natural products.

G. T. Brooks

The neem tree: source of unique natural products for integrated pest management, medicine, industry and other purposes, ed. H. Schmutterer, VCH Weinheim, Germany, 1995, 716 pp., price DM198.00. ISBN 3-527-30054-6

Heinrich Schmutterer is recognised internationally for his work with the neem tree and its beneficial biological effects. This is a comprehensive review, put together by the world's leading authorities, on the biology and nomenclature of the tree, the biologically active secondary metabolites that it contains and the activity of these components against a range of living organisms from viruses and bacteria, through insects and mites to vertebrates. It is followed by discussions on the practical results that have been achieved with neem extracts in the field with particular reference to integrated pest management, activity against arthropods and the risk of resistance developing. A short chapter on the toxic effects of neem against vertebrates and non-target organisms probably reflects the lack of data rather than the lack of effect. That there may be other long-term toxic effects was suggested by the chapter that deals with the use of neem and neem extracts as medicines in folklore. I know that I am an unbeliever when it comes to alternative medicine but how is it possible that a compound used as an agent for abortion or as an oral contraceptive can have no deleterious effects in its use in crop protection? Maybe it is insufficiently stable to remain as the active component on the crop but if this is the case will it not also have to be applied frequently to give long-term protection? I was disappointed to find a chapter on the socioeconomic and political considerations of neem use because these chapters always denigrate chemical crop protection and advocate grinding up plants and using them, with no control on dose or product quality, for frequent application to food crops, livestock and residences to control insect pests. This chapter is no exception and although it is often cost-effective to grow your own insecticides, the wanton and uncontrolled use of compounds with such broad biological activity and subject to contamination by mycotoxin-producing fungi should be accompanied by warnings of potential problems. The book closes with a chapter on other Meliaceae plants that possess secondary metabolites with biological activity.

But this review should not be a criticism or a commendation of the product, it must be a review of the book. As such the book is a full and extremely well referenced examination of the plant and its close relatives. It describes the chemistry of the compounds and gives detail of the biological effects. Unfortunately, in most cases there is no reference chemical compound included in the bioassays so it is not possible to be certain of the relevance or reliability of the assay and it is, therefore, difficult to be sure that the effect of the neem compounds is a useful effect. This is particularly true of